CLAIMS

1. In a plasma sputter reactor having a chamber arranged about a central axis, a target comprising a material to be sputtered, and a pedestal for supporting a substrate in opposition to said target along said central axis across a processing space, a sputtering process comprising:

impressing a DC magnetic field of a first magnetic polarity parallel to said central axis in a half of said processing space closer to said pedestal;

injecting a sputter working gas into said chamber;

electrically biasing said target to excite said working gas into a plasma to thereby sputter said material of said target; and

RF biasing said pedestal to create a negative DC bias on said pedestal.

2. The process of Claim 1, wherein said material comprises copper.

3. The process of Claim 1, wherein said material comprises tantalum.

4. The process of Claim 3, wherein a nitride of tantalum is sputter deposited on said substrate.

5. The process of Claim 1, further comprising inductively coupling RF power into said chamber.

6. The process of Claim 5, wherein said material comprises copper.

7. The process of Claim 5, wherein said material comprises tantalum.

8. The process of Claim 7, wherein a nitride of tantalum is sputter deposited on said substrate.

9. The process of Claim 1, further comprising rotating about said central axis on a back side of said target a nested magnetron comprising an inner pole having a second magnetic polarity along said axis and producing a first integrated magnetic flux and an outer pole surrounding said inner pole, having a third magnetic polarity opposite said second magnetic polarity, and producing a second integrated magnetic flux at least 50% larger than said first integrated magnetic flux.

10. The process of Claim 9, wherein said first and third magnetic polarities extend along a same direction.

11. A plasma sputter reactor, comprising:

a vacuum chamber with sidewalls arranged around and substantially parallel to a central axis;

a pedestal for supporting a substrate in said vacuum chamber;

a sputtering target positioned in opposition to said pedestal along said central axis, a processing space being defined in a region between said pedestal, said target, and said sidewalls;

a magnetron positioned on a side of said target opposite said processing space;

auxiliary magnets disposed at least partially around said processing space adjacent to said sidewalls and having a first magnetic polarity extending parallel to said central axis; and

a coil wrapped around the processing space configured to inductively couple RF power into said chamber.

12. The reactor of Claim 11, wherein said target comprises copper.

13. The reactor of Claim 11, wherein said target comprises a refractory metal selected from the group consisting of Ta, Ti, Co, and W.

14. The reactor of Claim 13, wherein said refractory metal comprises Ta.

15. The reactor of Claim 11, wherein said magnetron is rotatable about said central axis and comprises (a) an inner pole having a second magnetic polarity extending parallel to said central axis and producing a first integrated magnetic flux and (b) an outer pole having a third magnetic polarity opposite said second magnetic polarity and producing a second integrated magnetic flux.

16. The reactor of Claim 15, wherein said second integrated magnetic flux is at least 50% greater than said first integrated magnetic flux.

17. The reactor of Claim 16, wherein said first and third magnetic polarities extend along a same direction.

18. The reactor of Claim 11, wherein said auxiliary magnets produce a magnetic field extending along said central axis in a half of said processing space adjacent said pedestal.